

MULTIPLE FREQUENCY RECEIVER/PLAYER

Technical Field

The technical field relates generally to audio distribution systems. More specifically, the technical field relates to audio distribution systems utilized in automobiles and other moving vehicles, wherein such systems enable multiple persons present in such vehicles to listen to distinct audio programs without interference from other audio programming being presented simultaneously to other persons.

Background

When traveling in automobiles, various occupants often desire to listen to distinct audio programs. For example, an adult occupant (which may be the driver or a passenger) might desire to listen to a certain type of music (for example, classic rock) whereas a teenage passenger might desire to listen to another type of music (for example, rap). Commonly, most automobile audio systems are equipped with certain standard audio components that allow a driver or passenger to select only a single output signal that is presented throughout the vehicle even though multiple input sources may be available. For example, an auto sound system might be configured to receive input signals from compact discs, cassette tapes, radio stations, television stations (when the automobile is video equipped), GPS signals, cellular communications and various other sources of information. Figure 1 provides a schematic illustration of a simple system 100 in which standard audio sources are provided.

As shown, such a system 100 commonly includes a receiver and amplifier 102 that receives signals from various input sources, amplifies the signal and outputs the selected signal to various speaker systems. Further, the system 100 commonly includes an antenna system 108 (which suitably includes any necessary pre-amplifiers, filters, and the like) that is connected to the receiver 102 through a communications medium 103 at an input port 114 on the receiver 102. As is commonly appreciated, the antenna 108 (and, by correlation, the receiver 102) may be configured to receive communications signals on various frequencies including, but not limited to, AM radio frequencies, FM radio frequencies, broadcast TV frequencies, satellite TV frequencies, cellular frequencies, and other frequencies commonly used to receive and/or transmit communications signals. The receiver 102 suitably selects a communications signal from the antenna for reception and amplification when desired.

The system 100 also commonly includes various input sources such as a cassette tape deck 104 and/or a compact disc player 106. These are suitably connected to the receiver 102, for example, through communications link 105 and 107 and through input ports 116 and 118, respectively. Further, it is common for the compact disc player 106 and/or cassette tape deck 104 to be integrated into a single unit with the receiver 102.

Various speakers 110 and 112 are also commonly connected to the receiver 102. Often four, six, or even eight speakers are provided in an automobile sound system. For purposes of simplicity, two speakers are shown in Figure 1. Further, it is commonly appreciated that the speakers are often assigned to specific locations in the vehicle, for example, front speakers versus rear speakers. Suitable output ports 120 and 122 are usually provided by the receiver 102 and are used to connect the multitude of speakers to the receiver 102. While volume control knobs are often provided and by which occupants may adjust the sound volume in a given location within the automobile, such systems 100 generally require all the occupants of the automobile to listen to the same audio signals

Therefore, while automobile sound systems in recent years have increased tremendously the number of input sources, output ports and the quality of the sound provided in automobiles, there still exists a need for systems that enable various occupants to listen to one audio signal while other occupants listen to other audio signals. In short, a system is needed that enables occupants to listen to those audio programs they desire in an automobile while other occupants listen to a different audio program at the same time, without requiring the occupants to provide their own sound distribution systems (i.e., without requiring certain occupants to utilize a MP3 player, a SONY® WALKMAN®, a "boom box", or a similar device).

Further, automobiles often now include video systems, GPS systems, mobile computing systems and other systems that provide audio, video, graphical, textual, and/or other types of information signals. As such, the need is ever greater for a system and process that enables occupants and/or groups of occupants to be presented with specific audio/video signals while other occupants are presented with a different audio/video signal.

Summary

A system is provided that enables occupants of a vehicle to select specific audio programs for presentation to such occupant without requiring other occupants to listen to the same audio program. The system also enables such other occupants to select other audio programs which they may listen to simultaneously with the presentation of the first

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1 audio program. While the present Summary and Detailed Description are directed
2 towards an audio sound system and audio signals, it is to be appreciated that the present
3 invention is not to be construed as being so limited. Audio, video, graphical, textual and
4 other types of signals may be suitably communicated to specific occupants or groups of
5 occupants. As such, throughout this description audio signals are to be interpreted as
6 including, where appropriate, video signals, graphical signals, textual signals and signals
7 in other formats that can be suitably presented to a person.

8 In one embodiment, a system is provided that utilizes many of the input signals
9 provided by commonly available input devices, for example, radio frequency signals
10 provided through an antenna, signals from a cassette tape deck, and/or signals from a
11 compact disc player. These signals are received by a single receiving device that includes
12 multiple receiver/amplifiers, and multiple output channels. Input mixers are suitably
13 provided and utilized to select an input signal for reception and/or amplification by one of
14 the device's receivers/amplifiers. Similarly, output mixers are suitably provided and
15 utilized to select which received and amplified signal is to be provided to a specific audio
16 presentation device (for example, a speaker or a headphone). The location of the selected
17 audio presentation device and the connection thereto, through the receiver/amplifier, to a
18 given audio signal is suitably controlled by a simple and easy-to-use interface provided
19 by the device.

20 In another embodiment, a system further includes a transmitter that allows for the
21 separate transmission of audio signals to wireless devices (for example, head-phones).
22 Preferably, a transmitter is provided that is capable of transmitting multiple audio signals
23 over multiple communications channels. Further, in yet another embodiment
24 combinations of wired and wireless connections may be utilized to present distinct audio
25 signals to specific occupants in an automobile and/or to specific regions of an automobile.

26 These and other features are further described herein with reference to the drawing
27 figures, detailed description and the claims.

28 **Description of the Drawings**

29 Figure 1 is a schematic representation of a conventional audio sound system
30 commonly utilized in automobiles;

31 Figure 2 is a schematic representation of one embodiment where multiple audio
32 signals are simultaneously presented to specific regions of an automobile through a wired
33 speaker system;

Figure 3 is a schematic representation of another embodiment where multiple audio signals are simultaneously presented to specific occupants of an automobile through a wireless sound distribution system;

Figure 4 is a schematic representation of another embodiment where multiple audio signals are simultaneously presented to occupants of an automobile through a combined wired and wireless sound distribution system; and

Figure 5 is a flow chart illustrating one method by which a receiving unit may be configured to provide multiple channels to specific occupants and/or groups of occupants in an automobile.

Detailed Description

As discussed previously, a system is provided for presenting a plurality of audio signals to various occupants of a vehicle. More specifically, the system enables occupants of a vehicle to listen to various audio signals without requiring all the occupants to listen to the same signal and without requiring the occupants to utilize additional and/or stand-alone sound reproduction systems (for example, separate WALKMAN® units or the like).

As shown in Figure 2, one embodiment of a system 200 for presenting multiple audio signals to occupants of an automobile utilizes a multiple channel receiver and amplifier system. The system 200 includes a receiving unit 202 that further includes a multi-channel receiver/amplifier 206. In Figure 2, the multi-channel receiver/amplifier 206 is illustrated as a two channel unit. It is to be appreciated, however, that any number of channels may be configured into the multi-channel receiver/amplifier 206 as particular needs may determine. For example, in a large automobile, carrying numerous persons (for example, a six passenger mini-van) a channel may be desired for every seat in the vehicle (i.e., a six channel unit may be desired). Contrarily, for a small vehicle (for example, a two passenger sports car) only two channels may be desired. Further, in most applications, it is anticipated that a two channel unit is sufficient to address the various listening needs of most occupants of an automobile.

Further, the receiving unit 202 also includes an input mixer 204 and an output mixer 208. As is commonly known and appreciated in the art, input and output mixers may be provided in solid-state components, or more commonly as portions of an integrated circuit or a circuit assembly. As such, in some devices the input and output mixers may not be separate or distinguishable units and may be provided as an element of the processing features and functions of a receiving unit 202. Thus, it is to be appreciated

1 that the input and output mixers 204 and 208, respectively, are provided in Figure 2
2 primarily for illustrative purposes and the receiving unit 202 is not to be construed as
3 being limited to such an actual configuration and/or embodiment.

4 As illustrated in Figure 2, the input mixer 204 is configured to receive a plurality
5 of input signals from a plurality of sources at input terminals 114, 116 and 118. For
6 example, sources may include a cassette tape deck 104 or a compact disc player 106, or a
7 similar device that provides a signal from a portable storage device, for example, a
8 compact disc, a magnetic tape, a video tape, a digital versatile disc, a memory stick or any
9 other data storage medium. Further, the input mixer 204 may be connected to an
10 antenna(s) 108 that is configured to receive electromagnetic signals at various
11 wavelengths. As is commonly known, such signals may include radio signals, cellular or
12 other wireless communications signals, television signals, satellite signals and any other
13 signal capable of being communicated to a receiving unit. Further, such sources 104,
14 106, and/or 108 are also connected to the input mixer 204 through appropriate or desired
15 communications links 105, 103, and 107, respectively. Such communications links may
16 be wired or wireless.

17 As shown in Figure 2, the input mixer 204 effectively establishes connections
18 between a given source and a channel provided by the multi-channel receiver/amplifier
19 206. For purposes of illustration, nodes 210 and 212 are shown as providing inputs to
20 respective channels in the multi-channel receiver/amplifier 206. It is to be appreciated,
21 however, that the various channels provided by a receiving unit may be received,
22 amplified and output by a single amplifying circuit that utilizes the needed filters,
23 amplifiers, and other devices necessary to so configure a multiple channel output signal.
24 Thus, any available multi-channel receiver/amplifier may be utilized or, alternatively,
25 multiple instances of single channel receivers/amplifiers may be used.

26 Further, as illustrated in Figure 2, such receivers/amplifiers effectively include
27 output nodes 214 and 216 that correspond to the given channels. The signals at such
28 output nodes 214 and 216 are appropriately routed by the output mixer 208, or its
29 functional equivalent, at any instant and/or as specified by a user to a desired output
30 device. Examples of such output devices may include, for example, the front audio
31 speakers 110 and the rear audio speakers 112 in an automobile. As illustrated, each such
32 set of speakers may be configured to receive any of the plurality of channels processed by
33 the multi-channel receiver/amplifier 206. For example, the channel 1 signal might be
34 connected to both node 120 and node 122, from which suitable connections 109 and 111

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(which may be wired or wireless) are provided to the audio speakers 110 and 112. Alternatively, channel 1 might be configured to be presented on only the rear audio speakers 112, through node 122 only, while channel 2 is configured to be presented on only the front audio speakers 110, through node 120 only. As such, numerous combinations and permutations may be provided by the plurality of input sources, the number of channels on the multi-channel receiver/amplifier 206 and the number of output devices.

Further, the receiving unit 202 is preferably configured so that users may easily specify particular signals to be presented to users through particular output devices. In short, the system 200 may be configured such that the users specify the destination of particular audio channels. In additional embodiments, the system 200 may also be configured such that the receiving unit 202 automatically routes the audio signal to specific output devices based upon the type of signal received, driving regulations (for example, video signals should not be presented to a driver of a moving vehicle) and the intended audience.

For example, when the antenna 108 receives a wireless telephone call intended for the driver, the system may be configured to automatically present the call to the driver through output devices proximate to the driver. Meanwhile, music or other audio signals may be increased in volume in the proximity of other passengers, as desired and/or necessary. Such a configuration may create some semblance of privacy in a call (by prohibiting others from hearing the call), while minimizing the interference of other audio signals during the call. Thus, it is to be appreciated that the receiving unit 202 may be configured to manually and/or automatically distribute audio signals, as desired, to a plurality of output devices.

Referring now to Figure 3, another embodiment of a system 300 is illustrated. In this embodiment, the receiving unit 302 further includes a multi-channel transmitter 302. The multi-channel transmitter 302 is appropriately configured to transmit electromagnetic signals on appropriate communications links 308 and 310 at appropriate frequencies to receiving units, such as a set of combined receiver and audio headphones 304 and 306, respectively. In this embodiment, even greater selectivity and/or exclusivity of audio communications can be provided since various occupants of an automobile may be presented with unique audio signals that only they can hear through the wireless headphone devices.

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Figure 4 illustrates another embodiment of a system 400 wherein both general broadcast audio signals can be presented through an audio speaker 112 and private communications can be provided through headphones 304. In Figure 4, the transmitter 402 is illustrated as a single channel transmitter, however, it is to be appreciated that multiple channel transmitters may be utilized as desired. Similarly, only rear audio speakers 112 are illustrated. As discussed previously herein and provided in the previous embodiments multiple speaker arrangements may be utilized as desired. Thus, Figures 2-4 illustrate various embodiments that may be utilized to provide multiple audio and/or video channels in an automobile so that specific occupants, areas of a vehicle, or other groupings may be presented with specific audio and/or video signals. As discussed previously, such groupings may be predetermined, manually specified, and/or automatically specified. Further, the automatic specification may be based upon the intended audience for a given audio/video signal, the content of the audio/video signal, and/or any other parameter. Such parameters may be suitably loaded or programmed into the receiving unit 202 and stored in registers or a suitable data storage device (not shown).

Figure 5 provides a flow chart illustrating one method which may be utilized to specifically tailor audio/video signals to specific occupants in a vehicle. As shown this process begins (block 500) with specifying occupants or groups of occupants for a given audio channel and their relative position in a vehicle (Block 502). For example, a receiving unit 202 might be configured with preset buttons specifying, for example, front seat and back seat of a vehicle, adults and kids, driver and passengers, or any other designation. Similarly, a receiving unit 202 might be configured with a touch screen display (for example, on which one may identify positions of occupants in a vehicle and their desired audio selections). Similarly, a voice recognition unit, or other device may be utilized and may enable an operator of the receiving unit to specify how the automobile's audio distribution system (i.e., the combination of wired and/or wireless speakers and/or headphones) is to be configured. It is to be appreciated that as the number of channels provided by the receiving unit 202 increases, so does the complexity of specifying audio/video groupings. Therefore, to limit the amount of configurations necessary, the preferred embodiment utilizes a two channel receiving unit.

After specifying how a group of occupants are organized or located in the automobile and associated with a given channel, the process continues with the operator designating which audio signal is to be provided to a given channel (block 504). For

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1 example, a given channel may be designated to receive cellular telephone calls and a
2 signal from a radio station, while another channel may be configured to receive the audio
3 and/or video signals for a movie playing on a DVD player. Preferably, the selection of
4 the audio/video signal to provide through a given channel (which is associated with an
5 occupant or grouping of occupants) is accomplished after specifying the occupant
6 grouping. However, a system may also be configured such that the assignment of
7 audio/video signals to a given channel is accomplished first and the occupants that are to
8 receive a given channel are specified at a later time.

9 Regardless of the order in which the occupant to channel specification or the
10 audio/video selection to channel specification occurs, the process continues with
11 matching occupants to channels and channels to audio/video signal selections until either
12 all the occupant and audio/video selections have been specified (block 506), or all the
13 available channels have been specified (block 508). More specifically, when all the
14 occupants and audio/video selections have been specified (block 506), the process
15 continues with presenting the audio/video signals on the designated channels (510).
16 When additional occupant and audio/video selections remain to be specified (block 506),
17 the process determines whether additional channels are available (block 508). If
18 additional channels are available, the process then loops through blocks 502-508 until
19 either all the occupant and audio/video selections have been specified or nor are no more
20 additional channels available (block 508). At which instance, the process continues with
21 providing the desired audio/video signals on the specified channels to the occupants
22 (block 510).

23 It is to be appreciated that a given system is often limited as to the number
24 audio/video signals the system can present at any given time by the number of channels
25 provided by the system. However, it is also to be appreciated that a given channel may be
26 assigned (or switched between) more than one input signal source and the receiving unit
27 may be configured to appropriately select a signal available for a given channel based
28 upon the occurrence of a pre-determined event. For example, a channel might be
29 configured to provide an audio signal from a radio station until either a cellular call is
30 received or an outgoing call is initiated. In both instances, the receiving unit desirably
31 switches off the incoming audio radio signal and provides the cellular signal on the
32 channel, thereby facilitating a clearer cellular telephone call. Meanwhile, a second
33 channel (which may or may not, at that time, be configured to present a distinct signal)
34 may be configured to automatically continue presenting the audio radio signal to other

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1 areas or occupants of the automobile, and thereby provide some privacy to the occupant
2 receiving the incoming or outgoing call. Such privacy could be especially provided when
3 headphones were being used by certain occupants to receive an audio signal.

4 Upon presenting the audio/video signal(s) to the occupant(s) on the desired
5 channels, the process continues to provide such signals until the receiving unit: receives a
6 request to modify groupings of occupants with a channel (block 512); receives a request
7 to modify an audio/video signal associated with a given channel (block 514); or is turned
8 off (block 516). As shown in Figure 5, upon receiving a request to modify groupings of
9 occupants with a channel (block 512, the process continues with the operator again
10 specifying occupant grouping for a channel (block 502). Similarly, upon receiving a
11 request to modify an audio/video signal associated with a given channel (block 514), the
12 process continues with the operator again specifying an audio/video signal selection to
13 provide to channel (block 504).

14 Further, it is to be appreciated, that the receiving unit may be configured such that
15 a given channel is the active channel. When so configured, an operator may change the
16 input audio/video signal selections for the active channel without effecting the signal
17 selection being provided on another channel. Such a feature may be desirable, for
18 example, when children are watching a movie on channel two and the driver is constantly
19 surfing radio signals on channel 1. Further, in certain other embodiments, remote signal
20 controls may be provided in the vehicle, for example, in the rear seating area of a mini-
21 van. Such remote signal controls may be utilized by occupants in the general proximity
22 to control the volume, channel, and/or audio/video input selection provided on a channel.

23 While the present invention has been described in the context of certain system
24 embodiments and process flows, it is to be appreciated that the present invention is not so
25 limited and should be considered to include modifications, additions and deletions thereto
26 and such shall be considered to be within the scope of the present invention, as set forth
27 by the specification, the drawing figures and the claims.